PROCEEDINGS

53. IWK

Internationales Wissenschaftliches Kolloquium
International Scientific Colloquium

Faculty of
Mechanical Engineering

PROSPECTS IN MECHANICAL ENGINEERING

8 - 12 September 2008

www.tu-ilmenau.de

TECHNISCHE UNIVERSITÄT
ILMENAU

Home / Index:
http://www.db-thueringen.de/servlets/DocumentServlet?id=17534

Published by
Impressum

Publisher Herausgeber	Der Rektor der Technischen Universität Ilmenau Univ.-Prof. Dr. rer. nat. habil. Dr. h. c. Prof. h. c. Peter Scharff
Editor Redaktion	Referat Marketing und Studentische Angelegenheiten Andrea Schneider Fakultät für Maschinenbau Univ.-Prof. Dr.-Ing. habil. Peter Kurz, Univ.-Prof. Dr.-Ing. habil. Rainer Grünwald, Univ.-Prof. Dr.-Ing. habil. Prof. h. c. Dr. h. c. mult. Gerd Jäger, Dr.-Ing Beate Schlütter, Dipl.-Ing. Silke Stauche
Editorial Deadline Redaktionsschluss	17. August 2008
Publishing House Verlag	Verlag ISLE, Betriebsstätte des ISLE e.V. Werner-von-Siemens-Str. 16, 98693 Ilmenau

CD-ROM-Version:

Implementation Realisierung	Technische Universität Ilmenau Christian Weigel, Helge Drumm
Production Herstellung	CDA Datenträger Albrechts GmbH, 98529 Suhl/Albrechts

ISBN: 978-3-938843-40-6 (CD-ROM-Version)

Online-Version:

Implementation Realisierung	Universitätsbibliothek Ilmenau ilmedia Postfach 10 05 65 98684 Ilmenau

Home / Index:
http://www.db-thueringen.de/servlets/DocumentServlet?id=17534

53rd Internationales Wissenschaftliches Kolloquium
Technische Universität Ilmenau
08 – 12 September 2008

U. Fröber / M. Stubenrauch / D. Voges / C. Schilling / K. Bley / M. Koch /
M. Hoffmann / H. Witte

Bio-MEMS for Water Analytics

In recent years the sustainable and responsible consumption of drinking and industrial water has evolved to a critical factor. Global climate change will aggravate the situation in some regions of the world. The need to analyse water samples to detect changes in water quality such as chemical, physical and microbiological properties as well as the prove of pollutants and toxic substances will increase.

By law different methods to take and handle water samples are required. Organoleptic characteristics (odour, colour, turbidity, residuum) and physicochemical parameters (pH-value, oxygen and phosphate content etc.) are measured. Also microbiological tests using indicator organisms have to be executed [1].

For artificial bodies of water, such as swimming pools and wastewater treatments analytics with indicator organisms are preferred due to the high degree of purity of this type of water. It is necessary to insert organisms into the samples and to monitor their reactions (DIN 38412) [2]. A high experimental complexity is provoked by this tests. The populations used are not isophaseal, hence results give just an approximate impression about the influence of water quality on their vitality.

To simplify and improve the analysis an early warning system for pollutants and dangerous substances based on microsystem components currently is under development. The microsystems (Bio-MEMS) have to be standardised, robust and low cost. These systems can be installed as a distributed sensor system in the periphery of the public water supply for continuous observation.

For first tests adapted cultivation chambers for biological tests have been developed. They can be used as life support systems for single and multicellular indicator organisms (e.g. *Scendesmus*, *Tetrahymnea*, luminous bacteria, *Daphnia*). Successful long term experiments lasted about 48 hours. Morphological detectable reactions of specimen can be recorded to differentiate between clean and polluted water (Fig. 1).

A convenient way to gain the full effectiveness of significant test methods is the combination of several cultivation chambers to allow multistage experiments. This can

be done by cascading of structures (Fig. 2) or by combinatorial fluidic logic.

The systems presented will enable in-situ observations of single organisms or small and well defined populations as well as of cell cultures in micro-systems.

The moving range of the specimen is strictly restricted to the cultivation chamber with synchronous media support and microscopic observation. Thus, a real-time detection for water pollutants can be established to increase quality and security in water supply systems.

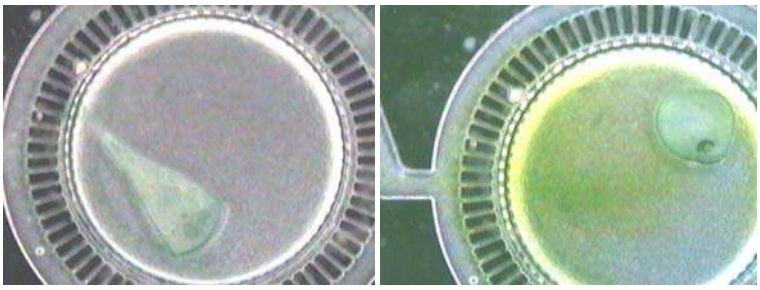

Fig. 1: reaction of an organism in clean (left) and polluted water (right) in the mikrosystem

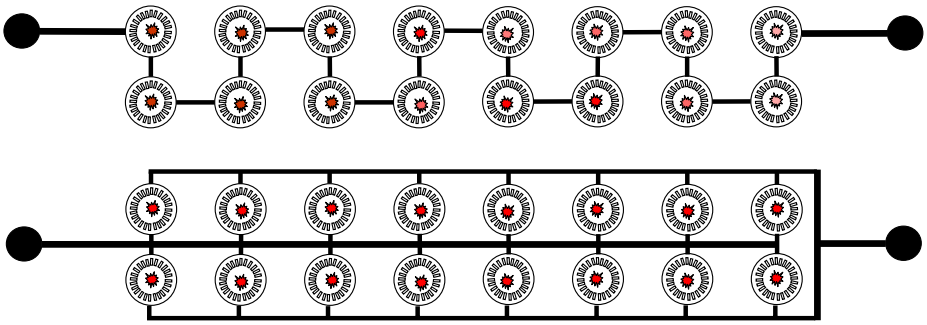

Fig. 2: cascading of cultivation chambers

References:

[1] Klee O.: „Trinkwasser untersuchen – einfache Analysemethoden und Beurteilungskriterien“, Quelle & Meyer, ’98
[2] Schäfer M., Tischler W.: „Wörterbuch der Biologie, Ökologie“, UTB für Wissenschaft, ’92
[3] DIN 38412 „Testverfahren mit Wasserorganismen (Gruppe L)“

Authors:

Ulrike Fröber*, Mike Stubenrauch**, Danja Voges*, Dr. C. Schilling*,
Univ.-Prof. Dr. Martin Hoffmann**, Univ.-Prof. Dr. Hartmut Witte*
Technische Universität Ilmenau, Institut für Mikro- und Nanotechnologien
FG Biomechatronik*, FG Mikromechanische Systeme**
P.O. Box 100565, D-98684 Ilmenau
Phone: +49 3677 69 1830
Fax: +49 3677 69 1280
E-mail: ulrike.froeber@tu-ilmenau.de

Kornelia Bley, Manfred Koch
-4H- JENA engineering GmbH
Mühlenstraße 126, 07745 Jena
Phone: +49 (0) 36 41 28 87 0
Fax: +49 (0) 36 41 28 87 26
E-mail: info@4h-jena.de